

ESA Planetary Protection Update

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NASA Planetary Protection Subcommittee Meeting
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1. ExoMars Program
2. Solar Orbiter
3. JUICE

ExoMars 2016



Mission elements: Trace Gas Orbiter (TGO) with EDL-Demonstrator Module (EDM)

Mission lead: ESA, cooperation with Roscosmos

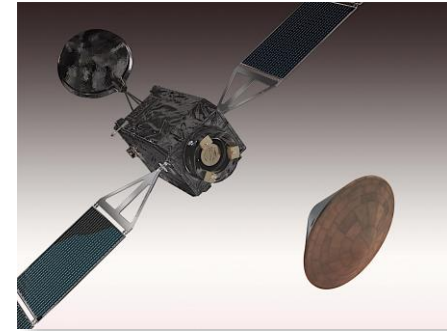
Use of perennial heat sources: No

Launch Site: Baikonur Space Centre, Proton Launcher

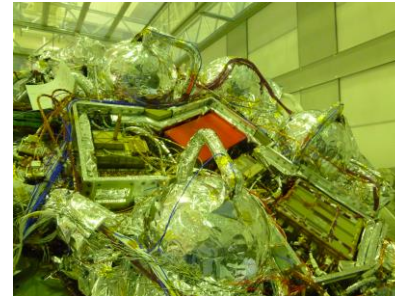
Planetary protection category: TGO-Cat. III, EDM-Cat. IVa

Planetary protection approach: Orbital lifetime for TGO, bioburden controlled assembly, bioburden controlled launch operation for Spacecraft Composite

Project status: completed CDR; shipment to launch site in October 2015



All pictures credit: ESA/ExoMars 2016



ExoMars 2018



Mission elements: Carrier Module (CM), Descent Module (DM), ExoMars Rover Module (RM) with Pasteur Payload (PPL)

Mission lead: Cooperation ESA-Roscosmos

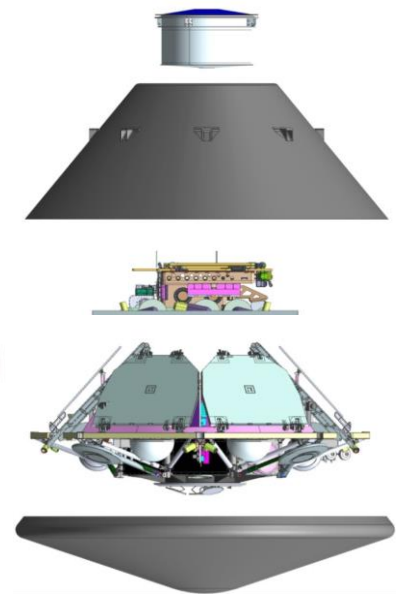
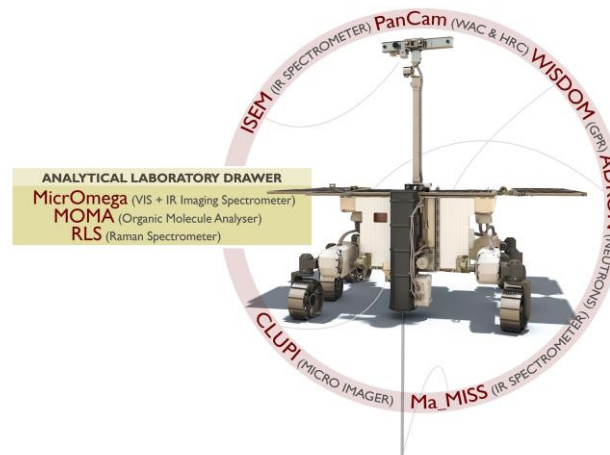
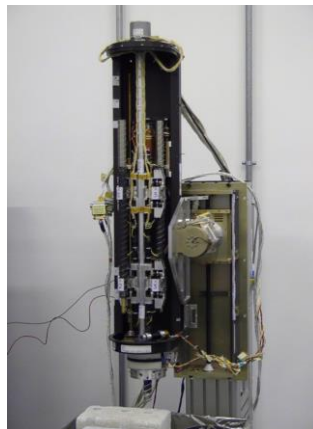
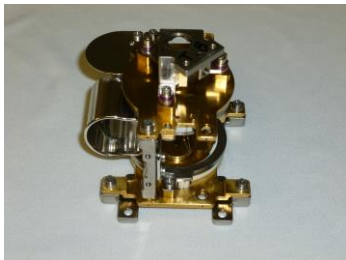
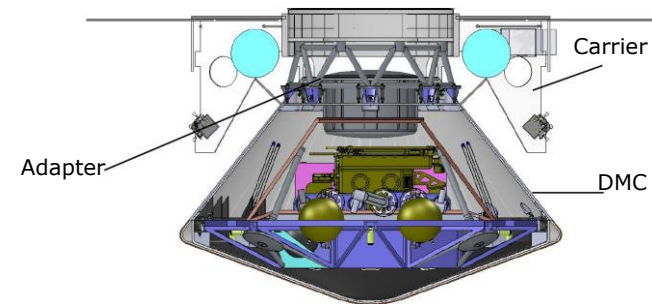
Use of perennial heat sources: Yes

Launch Site: Baikonur Space Centre, Proton Launcher

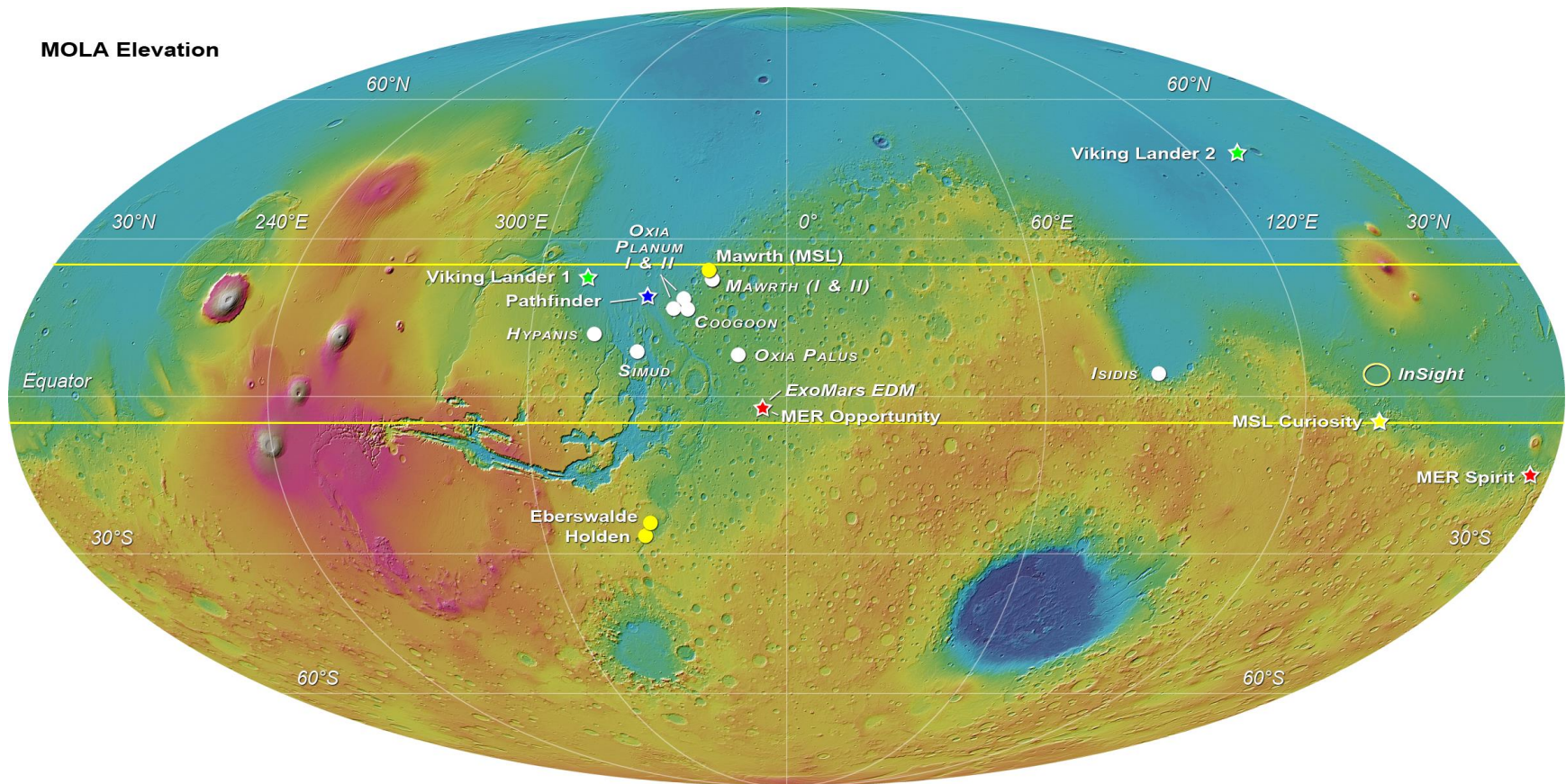
Planetary protection category: IVb

Planetary protection approach: bioburden control for CM (credit for break-up/burn-up), bioburden controlled assembly, bioburden controlled launch operation for Spacecraft Composite, sub-system IVb implementation (sample acquisition, transport and analysis) with recontamination prevention

Project status: completed PDR; landing site selection process on-going



ExoMars 2018



Launch date: 2018

Launch site: Kennedy Space Centre, NASA provided launch vehicle (Atlas V)

Orbit description: several orbits with a perihelion close to 0.28 AU and an inclination wrt the solar equator above 24° during the nominal mission phase and above 33° during the extended mission phase; the raise of the solar inclination is achieved by a series of gravity assist manoeuvres with Venus and Earth

Planetary protection category: II, due to Venus gravity assists; additional requirements to avoid impact on Mars

Planetary protection approach: preliminary analysis shows that launcher upper stage can meet the probability of impact constraint for Mars either by a dedicated upper stage maneuver that ensures that an uncontrolled Venus gravity assist does not allow the upper stage to cross Mars perihelion or by a biased launch trajectory for upper stage and the spacecraft; updated analysis provided by the launch service provider; for the spacecraft a detailed navigation and trajectory analysis has been carried out by the project for the different launch dates and demonstrated that the impact probability constraint for Mars is satisfied for nominal and off-nominal conditions, including end of life

Project status: CDR completed; planetary protection plan approved

Mission lead: ESA, L-class mission

Use of perennial heat source: no

Planetary protection category: III for Europa; category II (demonstrate “remote” potential for contaminating the liquid-water environment that may exist beneath the surface of Ganymede) was proposed for Ganymede by the project team (Astrobiology 13, no.10, 2013) and approved (March 2014)

Planetary protection approach: avoiding accidental impact on Europa with a probability of ≥ 99.9999 ; dedicated activity completed to improve the modelling of the dust and micrometeoroid environment in the Jovian system to better assess the impact on the Europa impact probability

Final S/C disposition: impact on Ganymede

Project status: mission adopted; currently in implementation phase; payload selected in 2013

Launch	June 2022 (August 2023)
Interplanetary transfer (Earth-Venus-Earth-Earth)	7.6 years (8 years)
Jupiter orbit insertion and apocentre reduction with Ganymede gravity assists	11 months
2 Europa flybys	36 days
Reduction of v_{inf} (Ganymede, Callisto)	60 days
Increase inclination with I0 Callisto gravity assists	200 days
Callisto to Ganymede	11 months
Ganymede (polar) 10,000x200 km & 5000 km 500 km circular 200 km circular	150 days 102 days 30 days
Total mission at Jupiter	3 years

Questions?



Credit: NASA/MRO HiRISE image ESP_033351_1780